EXPRESS MAIL CERTIFICATE
"EXPRESS MAIL" LABEL No.: EV369818061US
Date of Deposit: March 31, 2004
I hereby certify that this paper or fee is being deposited with the United States Postal Service "Express Mail Post office to Addressee" service under 37 CFR 1.10 on the date indicated above, addressed to: Attention: Mail Stop Patent Application, Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

Gretchen King

APPLICATION FOR UNITED STATES LETTERS PATENT

FOR

FLOATING PLATFORM WITH STORAGE TANKS FOR COMPRESSED GAS AND/OR HYDRATE FORMS OF HYDROCARBONS

Inventor: Richard D. Haun
Houston, Texas

Assignee: OPE Technology, LLC
Houston, Texas

BACKGROUND OF THE INVENTION

[0001] This application is a continuation-in-part of U.S. Patent application serial number 09/980,844 filed October 22, 2001.

1. Field of the Invention

[0002] The invention relates generally to offshore platforms and buoys with hull based separator and storage vessels and tanks for containment of hydrocarbon gases and their hydrate forms.

2. Description of the Related Art

[0003] Deepwater oil discoveries of hydrocarbons coupled with long distances to pipeline infrastructure cause small amounts of associated gas to be an increasing limitation to obtaining offshore domestic energy. Present solutions require installing extensive pipelines in increasingly deep water with very high capital expenditures that frequently prevent projects from going forward, increasing foreign oil import. Solutions in the past allowed reinjection of gas, although this is now not considered a responsible natural resource by operators.

[0004] Regulations in the interest of gaining the maximum value from natural resources and heightened environmental awareness, limit flaring, venting and re-injection of gas and give rise to the necessity of deep water offshore gas compression with storage and transit to the market without pipelines when they are cost prohibitive.

[0005] A solution to this issue would be to utilize economic floating platforms to collect, separate water and condensate, and store the hydrocarbon gas in a pressurized and/or cooled state for transfer by similar means as a mobile shuttle vessel. This approach is commonly used for storage and shuttling of oil around the world via floating

storage and offloading vessels termed FSO's or FPSO's with processing facilities as well. Transit ships for compressed natural gas (CNG) storage have been proposed and are being planned. However, the implementation of a fixed floating platform for storage of CNG has not been addressed in the marketplace. A related need is for a platform or facility that permits storage of the solid form of hydrocarbon gases, or their hydrate form as solids, within a floating platform.

SUMMARY OF THE INVENTION

[0006] The present invention provides an offshore floating facility for storage of hydrocarbon gas under controlled pressure and temperature and/or for storage of the hydrate form of hydrocarbons gas.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] For further understanding of the nature and objects of the present invention, reference should be had to the following drawings in which like parts are given like reference numerals and wherein:

[0008] Figure 1 presents an elevation view of a floating vessel in accordance with the present invention.

[0009] Figure 2 is an elevation view (partially cut-away) of the vessel shown in Figure 1.

[0010] Figure 3 is a detail view depicting an exemplary temperature control system for a storage vessel in accordance with the present invention.

[0011] Figure 4 is a block diagram illustrating steps in an exemplary storage method in accordance with the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0012] PCT international application serial number PCT/US00/10936, entitled

"Satellite Separator Platform" describes a floating vessel having a floating hull structure with a center column assembly that is extendable and retractable with respect to the hull structure. PCT/US00/10936, which is owned by the assignee of the present invention, is hereby incorporated herein by reference. That application describes the use of fluid separators within the center column assembly of the platform. In accordance with the present invention, there are provided means within the floating hull as well as atop the hull for storage of compressed gases and solid hydrates. Additionally, such storage may be provided within the center column assembly.

[0013] Figure 1 depicts a floating vessel 100 having a floating hull structure 102 and a center column assembly 104. The center column assembly 104 is retained within a hollow central section 103 (in Figure 2) and is axially moveable with respect to the hull 102 so that the center column assembly 104 is extendable and retractable below the hull 102. The center column assembly 104 preferably includes a plurality of longitudinal fluid separators 105 for separation of fluid components from a fluid mixture. The separators 105 may be gravity-type separators or hydrocyclone separators. The hull 102 presents an upper deck 106 for the support of a crane (not shown), a helipad (not shown) and other equipment useful for operation of the platform 100. Deck-mounted vertically-disposed storage vessels 200 and horizontally-disposed storage vessels 201 are shown supported upon the upper deck 106.

[0014] The elevation view provided by Figure 2 reveals storage vessels 202 within the hull 102 for containing hydrocarbon gases and/or hydrates. It is currently preferred that the floating vessel 100 be used for temporary storage of compressed natural gas and/or solid hydrocarbon hydrates. The storage vessels 202 provide storage and/or separation of the hydrocarbons. The storage vessels 202 may extend above the deck 106, as well.

The storage vessels 202 may further be provided with an environmental boundary 300, as shown in Figure 2, to improve the volumetric or separation efficiency of the vessels 202. The environmental boundary 300 is provided by a shell or jacket of protective insulation. Within the environmental boundary 300, the temperature of the contents of the vessels 202 would be controlled within a desired range. Insulation and other measures for temperature controls are provided. The outer surface of the vessels 202 are designed to include insulation methodology to reduce the transfer of heat to or from the surrounding seawater 204, hull 102, and deck 106 to the contained hydrocarbon gas or hydrates. Figure 3 illustrates, in schematic fashion, an exemplary temperature control system for the storage vessel 202 within the environmental boundary 300. A heated/cooled fluid 302 surrounds the storage vessel 202. An operably associated controller/heating-cooling/fluid replenishment/pressure control system 304, of a type known in the art, controls the heating/cooling coil 302 to maintain the storage vessel 202 and its contents at or near a predetermined temperature and pressure, based upon readings from sensor 305. The controller 304 also provides for replenishment and circulation of fluid 302 within the environmental boundary 300 via entry and return piping 303, 307. Although Figure 3 only shows the temperature control arrangement with respect to vessel 202, it should be understood that such may be used for all such storage vessels of the platform 100. Temperature control is important in the instance of hydrates to ensure that they do not sublimate and for gases, to ensure that they remain in their gaseous form.

[0015] Embodiments of the present invention provide for an offshore floating structure with separators and/or storage vessels for containment and control of gaseous or hydrate forms of hydrocarbons in either the center column assembly 104, within the hull

102, or upon the deck 106 of the hull 102. The systems and methods of the present invention provide for temporary or interim storage of hydrocarbon gases and solid hydrates following production from a well and prior to offloading and transport by transport tanker (not shown) to a remote location. In operation, a floating platform, such as platform 100 is positioned proximate a hydrocarbon production facility, such as an offshore well platform (not shown). It is then moored in place. Figure 4 illustrates steps for a method of storing CNG/hydrates upon the platform 100. Produced hydrocarbon hydrates and/or CNG is then transmitted to the platform 100 via hoses and other conduits (not shown) of a type known in the art (step 306). These materials are then stored within storage vessels 200, 201, 206 or 202 (step 308). Temperature is controlled for the storage vessel during storage of the materials (step 310). Finally, the materials are offloaded to a transport tanker (step 312).

[0016] Additionally, temporary/interim storage of hydrocarbon gases and/or solid hydrates may be accomplished within the context of the present invention within floating platforms having designs other than that of the floating vessel 100 described above. The solution of effective CNG or hydrate storage in a moored vessel for purposes of enabling CNG or hydrate transfer from the originating hydrocarbon sources (i.e., subsea wells) or at the market end can be achieved with many forms of fixed and floating vessels.

[0017] In addition, the platform 100 may provide for storage of hydrocarbon gases and/or solid hydrates within the center column assembly 104. Figure 2 illustrates storage vessel 206 within the center column assembly 104.

[0018] The best mode and preferred embodiments of the invention have been described. It is to be understood that the invention is not limited, thereto, but rather is to

be measured by the scope and spirit of appended claims.